Appendix 6

Uncertainty Analysis

Upper and lower boundary travel times to use for the risk assessment were computed based on the results of the uncertainty analyses. For purposes of this risk assessment, times of travel were computed by altering one parameter in each scenario. Vertical hydraulic conductivity of the confining unit was the tested parameter for the porous media scenario (Scenario 1). Porosity was the tested parameter for the preferential flow path scenario (Scenario 2).

Vertical hydraulic conductivity was evaluated by computing travel times based on variation of the mean vertical hydraulic conductivity by up to one order of magnitude above and below the mean value calculated from review of the scientific literature. Porosity was varied from 0.01 to 0.20, a range within typical porosity values found for limestones and dolomites (Freeze and Cherry, 1979). for the travel times computed in the preferential flow path scenario. Graphical representation of the uncertainty analysis time of travel computations can be found in Appendix Figures 6-1, 6-2 and 6-3 for Dade, Brevard and Pinellas Counties.

Upper and lower bounds of times of travel were computed from the results of the uncertainty tests. The first step in developing these bounds is to determine the statistical average time of travel ($t_{average}$) (Eqn. 17).

$$t_{average} = \frac{t_{90} + t_{10}}{2} \qquad \text{(Eqn. 17)}$$

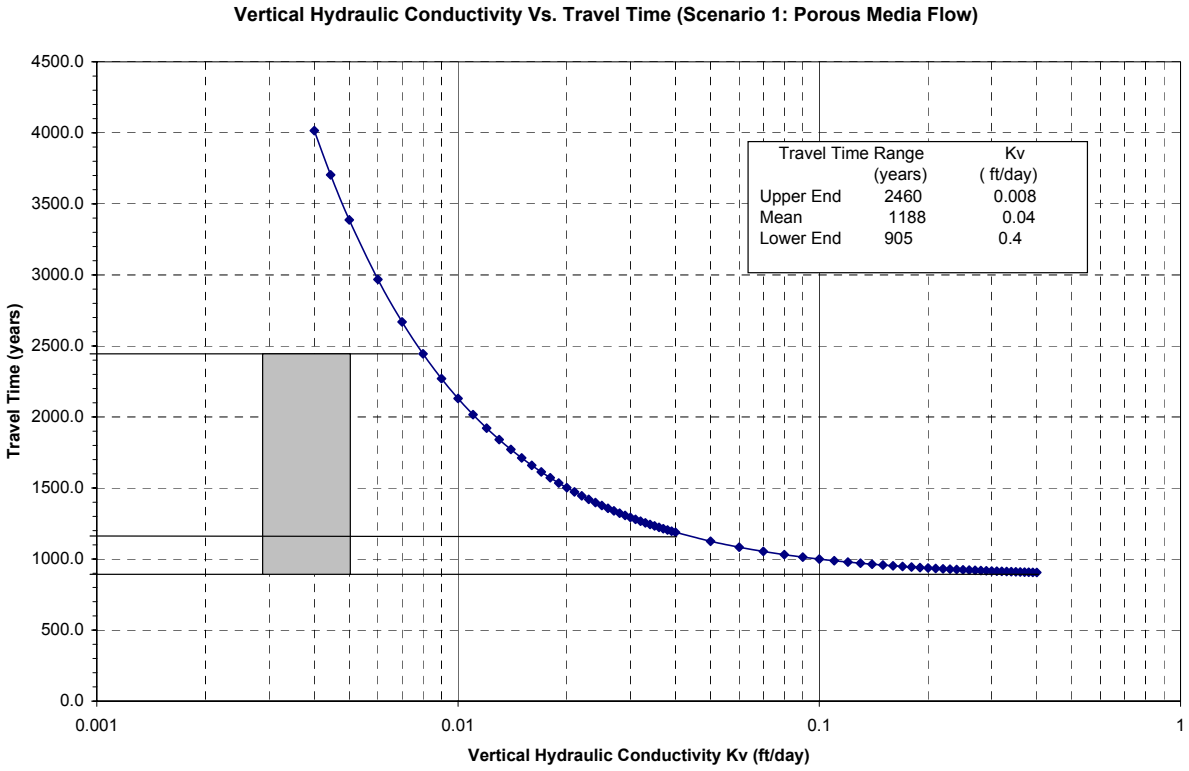
The t_{90} and t_{10} values are the vertical travel times associated with the ninetieth and the tenth percentile, respectively, within the range of the time of travel calculations for each scenario. The resulting $t_{average}$ value thus represents a statistical calculation that incorporates the weight of the travel time variations across two orders of magnitude for the lowest hydraulic conductivity unit, and across the reasonably expected range of porosity typically associated with preferential (i.e.- secondary) flow.

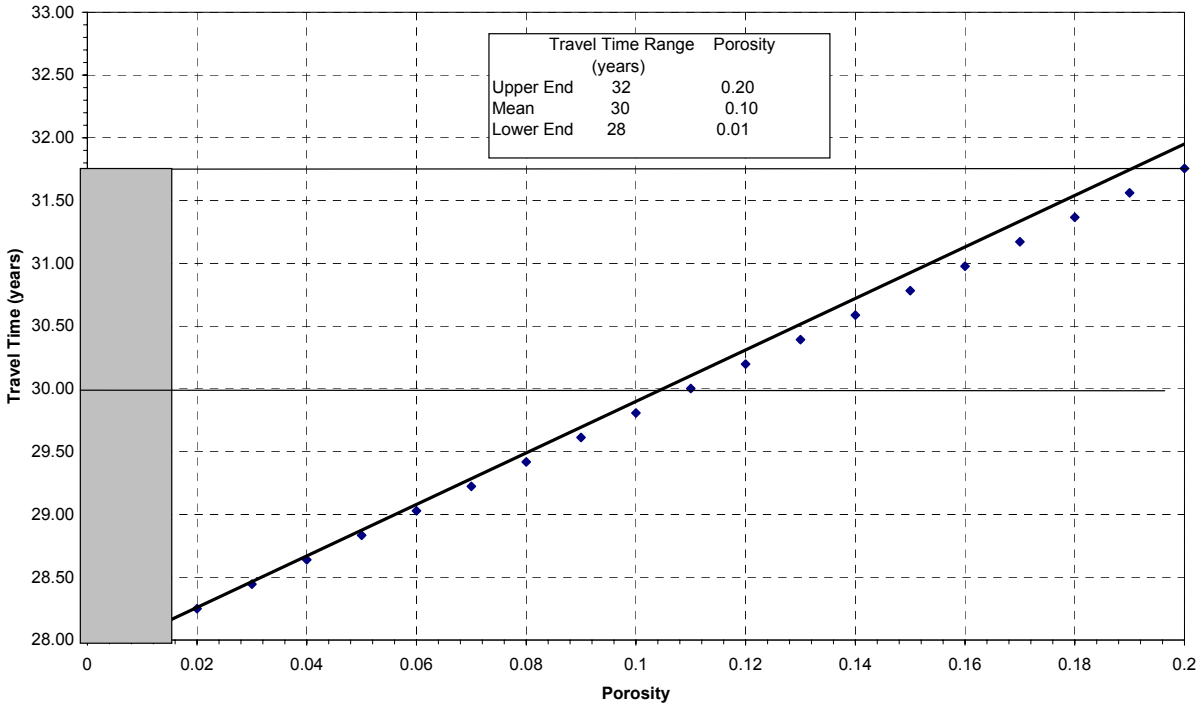
The upper and lower bounds for time of travel are then computed based on the relationship between $t_{average}$, computed in the uncertainty tests, and the vertical travel time (t) estimated earlier. Equations 18 and 19 depict the computations used to generate the upper and lower time of travel bounds, respectively:

$$t_{upper} = t + \left(t_{average} - t\right) \qquad \text{(Eqn. 18)}$$

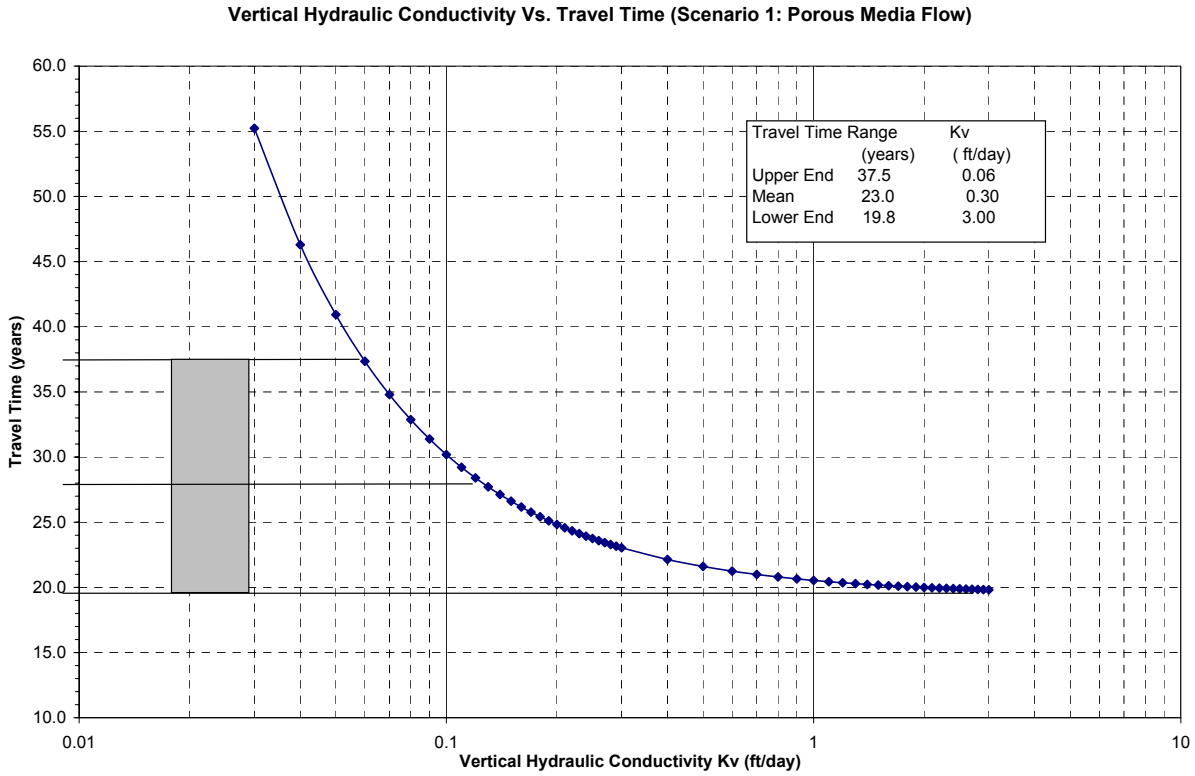
$$t_{lower} = t - \left(t_{average} - t\right) \qquad \text{(Eqn. 19)}$$

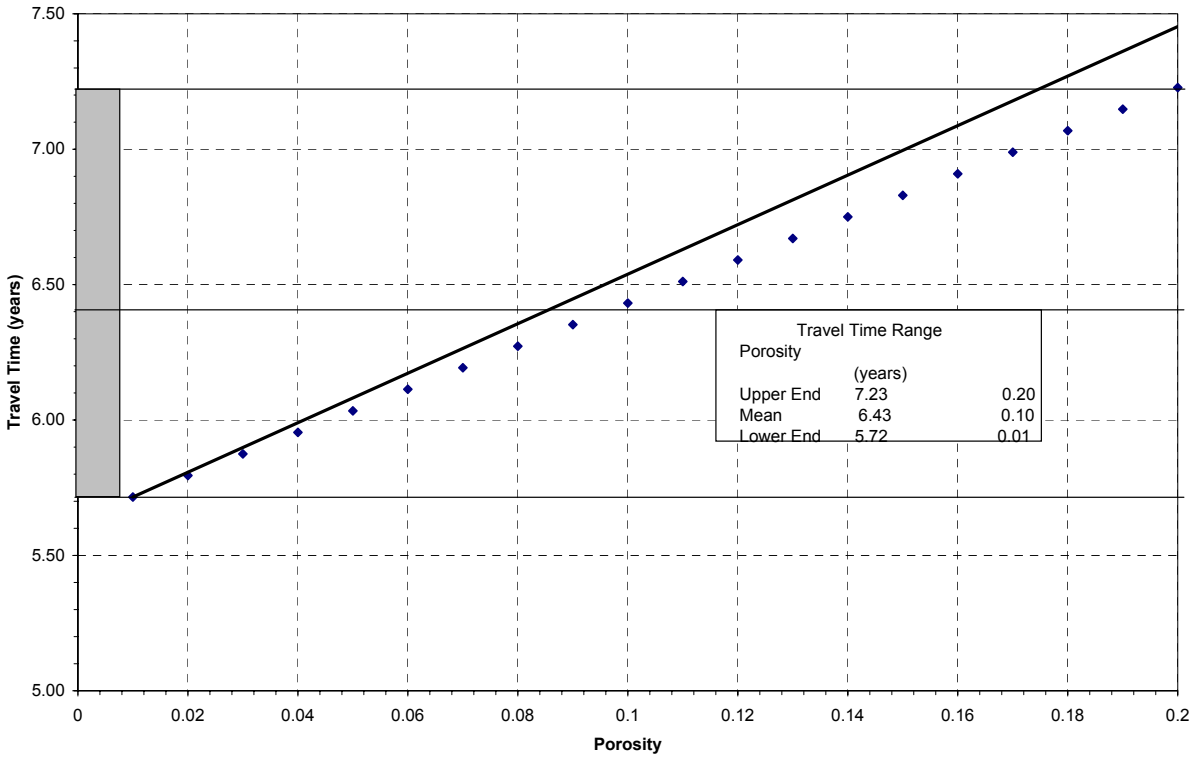
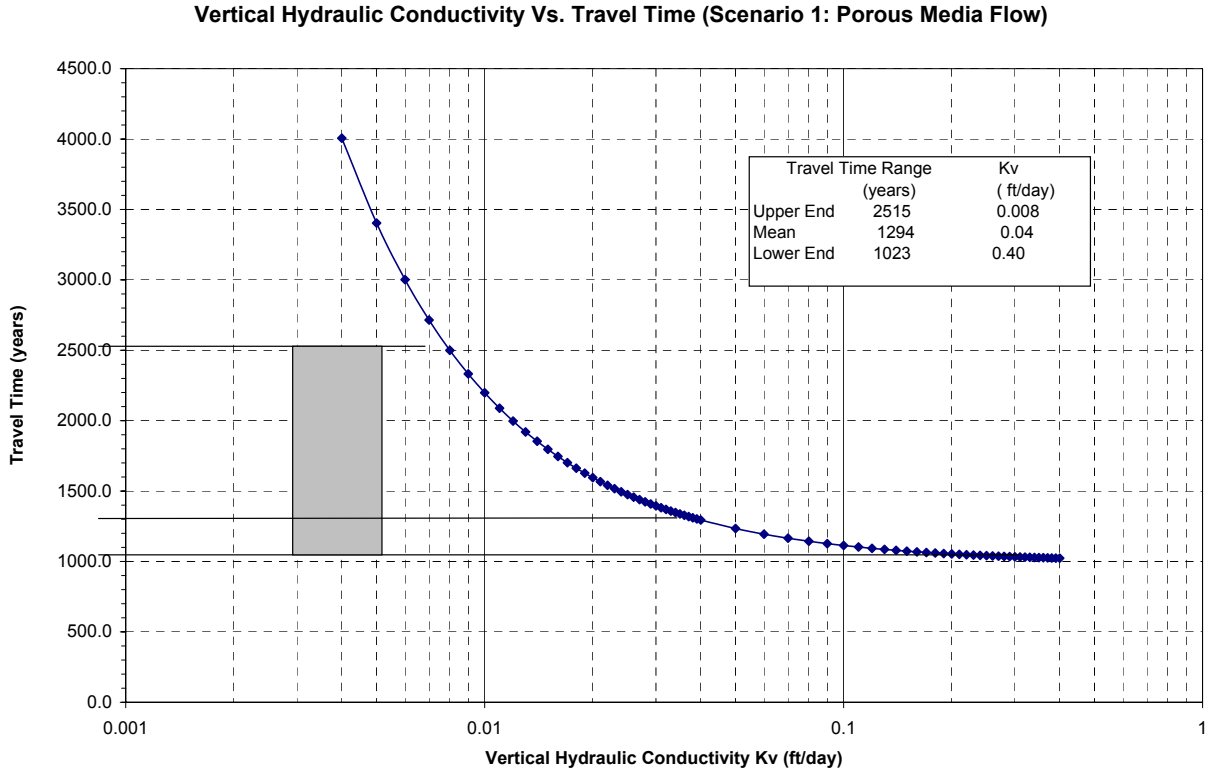
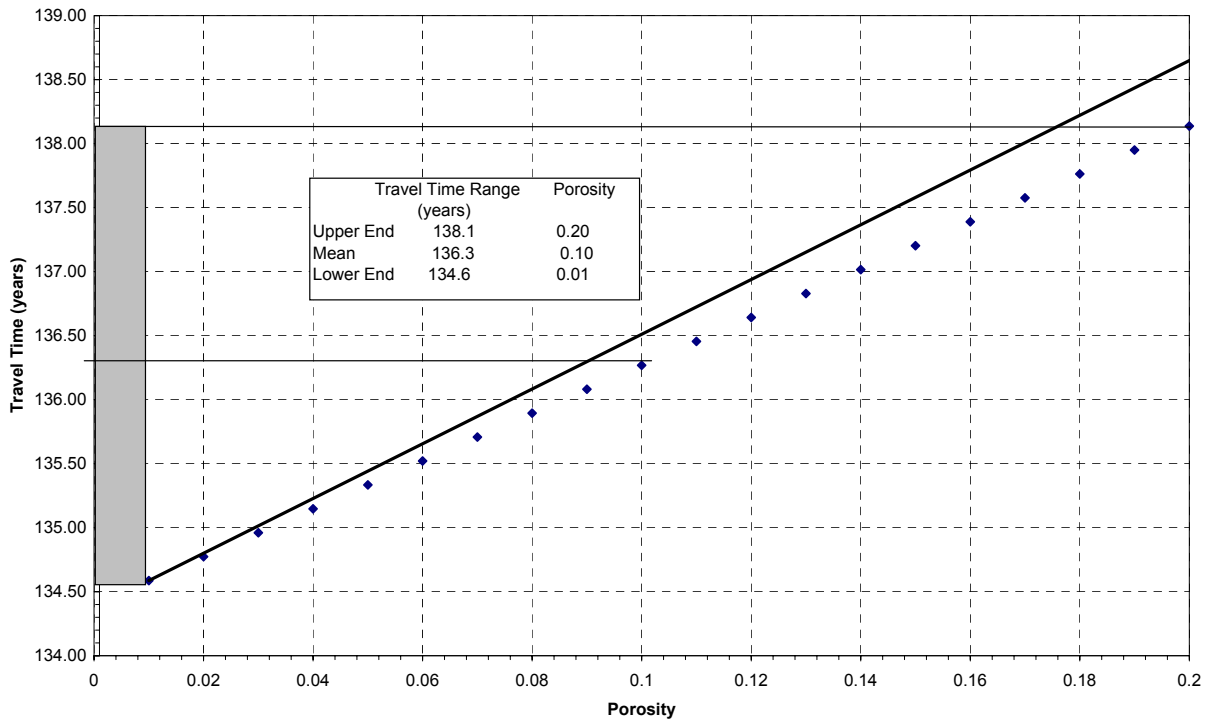
Appendix Figure 6-1
Uncertainty Analysis Results for Dade County





Appendix Figure 6-2
Uncertainty Analysis Results for Pinellas County





Appendix Figure 6-3
Uncertainty Analysis Results for Brevard County